US 20170219859A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2017/0219859 A1**

Christophy et al. (43) **Pub. Date: Aug. 3, 2017**

(54) **DISPLAYS WITH ADJUSTABLE ANGLES-OF-VIEW**

(71) Applicant: **Apple Inc.**, Cupertino, CA (US)

(72) Inventors: **Miguel C. Christophy**, San Francisco, CA (US); **Ming Xu**, Sunnyvale, CA (US)

(21) Appl. No.: **15/199,620**

(22) Filed: **Jun. 30, 2016**

Related U.S. Application Data

(60) Provisional application No. 62/290,081, filed on Feb. 2, 2016.

Publication Classification

(51) **Int. Cl.**

G02F 1/13	(2006.01)
H01L 27/32	(2006.01)
G02F 1/29	(2006.01)
F21V 8/00	(2006.01)
G02F 1/1335	(2006.01)
G02F 1/1334	(2006.01)

(52) **U.S. Cl.**

CPC ***G02F 1/1323*** (2013.01); ***G02F 1/133528*** (2013.01); ***G02F 1/1334*** (2013.01); ***G02F 1/29*** (2013.01); ***G02B 6/005*** (2013.01); ***H01L 27/3244*** (2013.01); *G02F 2001/294* (2013.01)

(57) **ABSTRACT**

A display may have a backlight unit that provides backlight illumination. The backlight unit may include a light guide that distributes light throughout the display and an electrically adjustable lens array. The lens array may have lenses such as liquid lenses or liquid crystal lenses. By adjusting the lenses in the lens array, the angles of rays of backlight from the backlight unit may be adjusted to adjust the angle-of-view of the display. The angle-of-view of the display may also be adjusted using an electrically controllable filter layer. The electrically controllable filter layer may have a liquid crystal layer or a polymer dispersed liquid crystal layer that can be controlled using electrodes. When the electrodes apply signals to the electrically controllable filter layer, portions of the filter layer change to a dark or translucent state and restrict the angle-of-view of the display.